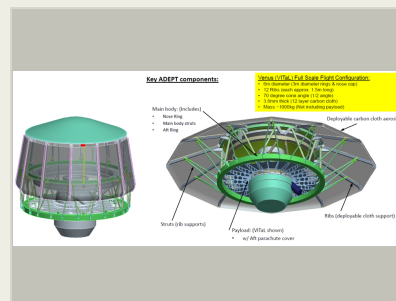
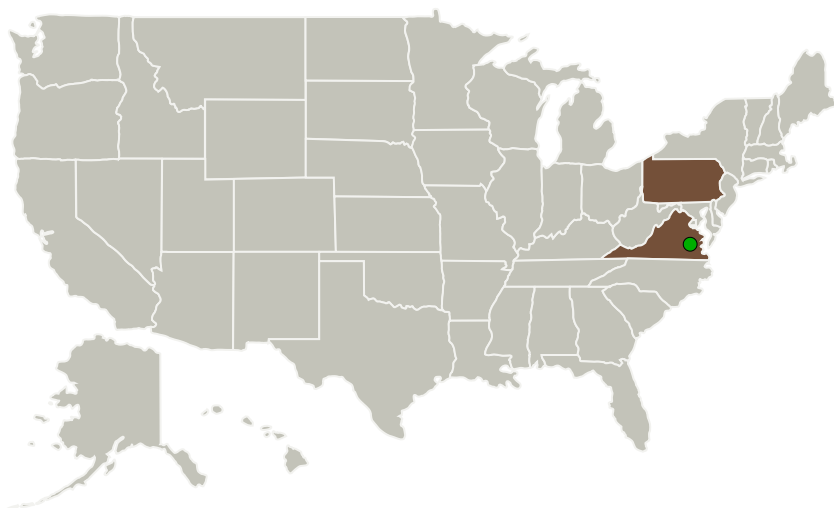


Project Introduction

Woven TPS (WTPS) is an attractive option for thermal protection because it allows for a design to be tailored to a specific mission. Material composition can be adjusted by weaving different fiber types together and controlling their placement using computer-controlled, automated, 3D weaving technology. NASA's HEET program is responsible for the development of WTPS, with the objective of enabling a broad range of missions. With complex material systems such as WTPS, there exists a need for in situ Structural Health Monitoring (SHM) capability designed to diagnose and report any degradation in the capability of the structure. The primary objective of the proposed effort is to leverage MR&D's micromechanics-based Program Suite to interpret measured temperature and strain data derived from fiber optic sensors that are structurally integrated in a 3D woven composite panel. Specifically, measured strains at the constituent level will be used to compute a local stress state in several 3D woven composite test specimens under a variety of thermal and structural loads. Measured temperature data will dictate which temperature-dependent constituent material properties to use in the micromechanics model. The proposed research offers a software solution for providing a physics based interpretation of sensor data acquired at the constituent level of a 3D woven structure and computes an effective composite level response for the purposes of evaluating structural health in near real time.

Primary U.S. Work Locations and Key Partners



Fiber Optic Health Monitoring of 3D Woven Preforms and Composites Employing Structurally Integrated Sensors, Phase I

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Completed Technology Project (2016 - 2017)

| Organizations Performing Work | Role | Type | Location |
|-------------------------------------|-------------------------|-------------|-------------------------|
| Materials Research and Design, Inc. | Lead Organization | Industry | Wayne, Pennsylvania |
| 🟢 Langley Research Center(LaRC) | Supporting Organization | NASA Center | Hampton, Virginia |
| Villanova University | Supporting Organization | Academia | Villanova, Pennsylvania |

| | |
|--------------|----------|
| Pennsylvania | Virginia |
|--------------|----------|

 June 2016: Project Start

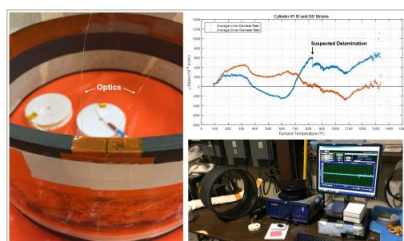


Closeout Documentation:

- Final Summary Chart(<https://techport.nasa.gov/file/139912>)

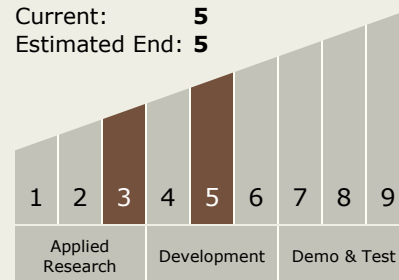
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Fiber Optic Health Monitoring of 3D Woven Preforms and Composites Employing Structurally Integrated Sensors, Phase I
(<https://techport.nasa.gov/image/136024>)



Fiber Optic Health Monitoring of 3D Woven Preforms and Composites Employing Structurally Integrated Sensors, Phase I Project Image (<https://techport.nasa.gov/image/128667>)

Start: **3**
Current: **5**
Estimated End: **5**



Fiber Optic Health Monitoring of 3D Woven Preforms and Composites Employing Structurally Integrated Sensors, Phase I

Completed Technology Project (2016 - 2017)



Technology Areas

Primary:

- TX12 Materials, Structures, Mechanical Systems, and Manufacturing
 - └ TX12.2 Structures
 - └ TX12.2.3 Reliability and Sustainment

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System